MANITOBA
DEPARTMENT OF NATURAL RESOURCES

ANNOTATED BIBLIOGRAPHY

RENEWABLE RESOURCE PUBLICATIONS OF THE DEPARTMENT OF NATURAL RESOURCES 1981

COMPILED BY LIBRARY SERVICES
MANUSCRIPT No. 82-1 WINNIPEG
1982

ANNOTATED BIBLIOGRAPHY

OF THE RENEWABLE RESOURCE PUBLICATIONS

OF THE MANITOBA DEPARTMENT OF NATURAL RESOURCES, 1981

compiled by

LIBRARY SERVICES

Manuscript report no. 82 - 1

Library

Manitoba. Department of Natural Resources

Winnipeg, 1982

TABLE OF CONTENTS

ABSTRACT iii

INTRODUCTION iv

LIST OF PUBLICATIONS
- Manuscript Reports 2
- Technical Reports 16
- Unnumbered publications - Fisheries and Wildlife . 16
- Parks Branch 17
- Water Resources Branch 18
- Books, periodical articles 21
- Surveys and mapping 23

INDEXES
- Author Index 25
- Branch Index 27
- Subject Index 28
- Title Index 31

ABSTRACT

74 publications in the areas of fisheries, forests, parks, water resources and wildlife management are listed and indexed. Abstracts are provided for most of the publications.

INTRODUCTION

The publications included in this fifth annual bibliography represent contributions from the Fisheries, Forestry, Parks, Surveys and Mapping, Water Resources and Wildlife Branches of the Manitoba Department of Natural Resources. A listing of the publications of Public Information Services can be obtained from that section. This listing is also complemented by the Manitoba Government Publications 1981 Check List compiled by the Legislative Library, which includes maps, brochures, and newsletter material not included in this listing.

Each report has its own distribution list as determined by the author. Enquiries for copies should be addressed to the authors concerned and not to the library. The general address is 1495 St. James Street, Winnipeg, Manitoba, R3H 0W9. Requests for loans should be made to the library, Box 26 at the above address, or phone 786-9290.

Citation of manuscript reports should be by permission of author and / or Section head, and referred to as a "personal communication."

Irene Hamerton,
Librarian.

LIST OF PUBLICATIONS

I. MANUSCRIPT REPORTS

1. 81-1. LIBRARY SERVICES. Annotated bibliography of the renewable resources publications of the Department of Natural Resources, 1980.

Forty two publications in the areas of fisheries, forests, land and wildlife resource management in the Province of Manitoba are listed, abstracted and indexed.

Subject headings: natural resources - Manitoba - bibliography; fisheries - Manitoba - bibliography; forestry - Manitoba - bibliography; land use - Manitoba - bibliography; wildlife - Manitoba - bibliography.

2. 81-2. JARDINE, C.G. AND J.S. SIGURDSON. A sport fisheries investigation of Sasaginnigak and Fishing Lakes, 1979.

Results from a 1979 summer creel census and fish sampling program conducted at fishing lodges on Sasaginnigak and Fishing Lakes were analyzed and compared.
Annual angler harvest was estimated at 8200 kg. at Sasaginnigak Lake and 10,600 kg. at Fishing Lake. Angling success was 0.63 walleye and 0.30 northern pike per angler-hour at Fishing Lake. Individual anglers harvested an average of 4.53 kg. and 6.11 kg. per day at each respective lake.
In general, approximately 50% of the fish caught were kept, although this proportion was higher for walleye at Fishing Lake. Each angler consumed an estimated 1.5 kg. of fish per day.
Growth of walleye and northern pike from Sasaginnigak Lake and northern pike from Fishing Lake was positively allometric while growth of walleye from Fishing Lake was negatively allometric. Population characteristics of creel census walleye were not significantly different from those of lake survey walleye at Sasaginnigak Lake. The majority of anglers originated from the north-central United States. Anglers at Sasaginnigak Lake were primarily of the professional and trade occupational classes, whereas those at Fishing Lake were retired or in the trades. Opinion of angling quality was positively correlated with previous angling experience and catch per angler-hour, but not with the weight of the fish kept.
The evaluation scheme defined by the anglers for catch per angler-hour provided accurate success standards for these two lakes, and was considered to be representative for lakes on the east side of Lake Winnipeg.

Total angler expenditures for the 1979 season were estimated at $509,000 for Sasa-Ginni-Gak Lodge and $376,500 for Fishing Lake Lodge, or which $265,000 and $301,200, respectively, was spent in Manitoba. The average expenditure per angler was $700 at Sasa-Ginni-Gak Lodge and $1,500 at Fishing Lake Lodge.

Subject headings: Fishing, Sport - Manitoba - Surveys; Sasaginnigak Lake, Manitoba; Fishing Lake, Manitoba.

3. 81-3. SEGARAN, S. Tree improvement and forest genetics programs in the Province of Manitoba. 1. Project details and specific objectives.

This publication consists of a listing of fifteen projects together with specific objectives to be undertaken in the tree improvement and forest genetics program of the Province over the period, 1981-86.
A brief introduction, a note on basic concepts, and a preface precede the listing of the projects.

Subject headings: Tree-breeding - Manitoba; Forest genetics.

4. 81-4. ERICKSON, C.M. & W. LYSACK. Seasonal and population growth parameters of southern Lake Winnipeg saugers.

A comparative growth study of saugers, (Stizostedion canadense), from southern Lake Winnipeg was undertaken in 1979 and 1980. Female saugers attain a larger asymptotic size at a faster rate than do male saugers. Saugers are recruited into the southern Lake Winnipeg fishery at a mean age of 3+ years.
Seasonal growth rates of young-of-the-year and yearling saugers were not significantly different between 1979 and 1980 but the 1980 growth curves were significantly higher than their 1979 counterparts. This difference in elevation is related to the elevation differences between 1979 and 1980 water temperature curves. Yearling saugers began growing in June and ceased growth in mid-September.
Young-of-the-year and yearling saugers consumed Chironomidae larvae exclusively during spring but changed their diet during the summer months and fed almost exclusively on emerald shiners.

Subject headings: Sauger - Lake - Winnipeg; Lake Winnipeg, Manitoba.

5. 81-5. GARROD, R.C., M.W. SHOESMITH & J.M. STEWART. Rumen analyses of white-tailed deer, elk and moose killed by hunters and vehicle collisions in Manitoba, 1975-1978.

Some seventy-two (72) plant taxa were found in the rumen samples of white-tailed deer (Odocoileus virginianus), elk (Cervus elaphus) and moose (Alces alces) from Manitoba, Canada.
For white-tailed deer, the leaf, seed and chaff tissue of grasses (Gramineae), the twigs and fruit of snowberry (Symphoricarpos spp.) and the stems of red osier (Cornus stolonifera) occurred most frequently in the identifiable fraction of the rumen contents. Grasses were predominant in the Winnipeg and south-western regions whereas snowberry twigs were predominant in the west and interlake regions. In the eastern region, lichens occurred more frequently in the diet.
Elk rumen contents were mostly grasses, wheat (Triticum spp.) and alfalfa (Medicago sativa) stems and leaves.
Moose rumen contents, in contrast, were predominantly browse with willow (Salix spp.) hazel (Corylus spp.) and poplar (Populus spp.) stems comprising the majority of the identifiable fraction.

Subject headings: deer, White-tailed - Manitoba - food; elk - Manitoba - food; moose - Manitoba - food; Rumen.

6. 81-6. BREDIN, E.J. Distribution of the Western hognose snake in Manitoba.

There are five species of snakes found in Manitoba, and perhaps the most intriguing of all is the Western Hognose snake, Heterodon nasicus.
The hognose appears as well in Saskatchewan and Alberta although the range is not continuous, with isolated occurences in short and mixed-grass prairies that combine with other factors to provide suitable habitat.
The hognose is a highly secretive and individualistic reptile which has, I believe, accounted for underestimates in the size of the Manitoba population.
I spent the months of July and August, 1980, doing extensive field work, with some field work in September conducting a distribution survey. The most important data gathered was a range extension of approximately 33 miles to the southwest of Oak Lake.

Subject headings: Western hognose snake - Manitoba.

7. 81-7. BREDIN, ERROL J. Distribution of the Northern Prairie Skink in Manitoba.

Little has been researched and published on the distribution of the Northern Prairie Skink, Eumeces septentrionalis septentrionalis, in Manitoba. The only lizard in the province, the skink occurs in the vicinity of Spruce Woods Provincial Park in southwestern Manitoba.
This is a unique and apparently relic population of lizards, isolated from the nearest populations to the southeast in Minnesota by 120 miles.
This report combines information I gathered over the years as an interested amateur, plus one summer of extensive field work (June-September, 1980) under the employ of the Department of Natural Resources.
This was primarily a distribution survey. The results have extended the known range 26.5 miles north to a point 3.5 miles east and 1.75 miles south of Neepawa and 1.5 miles northeast to a point approximately 7.5 miles north of Treherne.
In addition, for the first time I found skinks south of the Assiniboine River, a sighting being made approximately 1 mile west of the mouth of the Cypress River, on July 16, 1980.

Subject headings: Skinks - Manitoba.

81-8. Not completed.

81-9. Not completed.

8. 81-10. MILLIKEN, IAN J. Application of quadrat plot sampling to an aerial census of white-tailed deer in southwestern Manitoba.

An aerial census of white-tailed deer (Odocoileus virginianus) using the quadrat sampling technique was completed in Southwestern Manitoba on Game Hunting Area (GHA) 27 monitor block from January 28 to February 4 and on Game Hunting Area 31A from February 5 to 12, 1981. The census was flown in a STOL-equipped Helio Super Courier and was completed in 42.7 hours. Stratified random estimates ranged from 3.5 deer/mile^2 (2.6 km^2) on Area 31A to 3.9 deer/mile^2 on Area 27 monitor block. These data indicate an unchanged population in Area 26 and a population decrease for 31A. However, an inadequate sample size in the low density quadrats and a greater than normal distribution of deer in the low density quadrats may be the cause of this apparent population decrease.

Subject headings: Deer, white-tailed - Manitoba;
Aerial survey techniques - wildlife.

9. 81-11. MILLIKEN, IAN J. Lauder Sand Hills Wildlife Management Area habitat development project; stem counts 1978-1980. Southwestern Manitoba.

Fifty-five permanent one metre^2 plots were selected on eleven clearcutting sites in the Lauder Sand Hills Wildlife Management Area to estimate the amount of regeneration and changes in species composition following regeneration over a three year period. Trembling aspen (Populus tremuloides) and balsam poplar (P. balsamifera) declined from 182,201 stems per hectare in 1978 to 84,204 in 1980. Shrubs increased from 308,701 stems per hectare in 1978 to 313,310 stems per hectare in 1980, however, one species, raspberry (Rubus sp.), accounted for the increase as most other shrubs decreased in abundance.

Subject headings: Browse; Wildlife habitat improvement - Manitoba; Lauder Sandhills Wildlife Management Area.

10. 81-12. CRICHTON, VINCE, F.J. Moose in Manitoba - 1980.

Habitat maturation, severe winter weather and Indian hunting pressure in combination have resulted in a decreasing moose population in a substantial number of Manitoba's game hunting areas. Calf survival in the 1979/80 winter in many areas was substantially below the long-term average and with the aforementioned winter being severe in portions of the Interlake and Eastern Regions the prognosis is for a reduced calf crop in these areas in 1980. Moderate restrictions imposed previously do not appear to be reversing the downward trend. Indian hunting pressure and subsequent harvest are high in the Northwest, Interlake and Eastern Regions. In some areas, this harvest has exceeded the licensed kill and estimated annual productivity of these herds. The "boom" years of high moose populations following the large fires of the 1950's and early 1960's are in the past and habitat today in many areas has matured to the point where it is incapable of producing similarly high populations. Extensive fires in the spring of 1980 ensure the production of some excellent habitat in the next few years. This augers well for moose herds in these areas. The 1980 moose seasons will be divided into special draw seasons and general seasons as in the past. The former will remain similar to those of 1979 with an increase in the overall number of licenses allocated to these seasons. The general moose season in Game Hunting Areas 1, 2 and 3 will remain unchanged along with the non-resident seasons and the fall bull-only seasons in the general areas.

The major change will be to revert from an any-moose winter season to a bulls-only winter season in Game Hunting Areas 9, 7, 2A, 6A, 15, 21, 17A and 26 in addition to opening up a bulls-only winter season in Area 15A. These changes still allow hunting to occur in the winter seasons, however, the success rate will be reduced. It is estimated, based on previous harvests, that a minimum of 400 cows and calves will not be taken, thus protecting the female component of the breeding stock and recruitment. The only season to be completely closed in 1980 is the bull-only season in Game Hunting Area 20 where the native harvest alone exceeds the annual productivity resulting in a downward spiral of this herd. Although licensed hunting pressure is not believed to be the major cause of the recent decline, harvesting restrictions appear to be the only practical way to reverse the decline and hopefully commence to restore populations to levels compatible with the available habitat. The 1980 seasons as proposed will give an element of uniformity to the seasons compared to 1979, will stay away from additional draw areas which create expense for the Department and yet will still allow hunters the opportunity to hunt and the flexibility to move around with minimum restrictions. As populations increase, some winter "any-moose" hunting will again be permissible, however, it should not be assumed that this will occur in 1981.

Subject headings: moose - Manitoba.

11. 81-13. WIELGUS, ROBERT B. Effects of fire on the shrub layers of young and mature aspen forest and implications for moose habitat management.

Studies were conducted on the shrub layers of four forest types in a boreal forest, aspen parkland ecotone. A young, primarily deciduous forest had a greater density of basal stems, number of species and frequency of species than a similar mature stand. The greater number of young stand species resulted in a greater diversity index value. Species evenness was similar between stands. Burning of both age classes of forests resulted in an increase in stem density, but increases were greater in the mature stand. The number of species increased in the mature stand, but decreased in the young stand. In both cases, species evenness decreased, resulting in lower diversity index values. Species frequencies increased in the mature stand but decreased for young stand species. Burning of the mature forest resulted in an increase of beneficial browse characteristics for moose, while burning of the young forest resulted in a loss of essential moose habitat components. A controlled burning scheme is suggested where optimal moose forage and cover requirements are met.

Surveys and observations revealed that browse utilization during 1979/80 was greatest in mixed-woods forests. Moose avoided coniferous forests, young deciduous forests and open areas. Severe winter weather appeared to limit moose activity to mixed-woods stands. Browse supplies appeared adequate in most forest types with concern being warranted only for the mixed-woods stands. Blood values (total protein, urea nitrogen and cholesterol) and high calf mortality indicated that moose were in poor condition in spite of apparently adequate browse supplies. It is postulated that forage quality on some or all seasonal ranges, and forage quantity and quality on winter ranges are contributing to poor health of moose.

Subject headings: moose - Manitoba - Hecla Island; Browse.

12. 81-14. WIELGUS, ROBERT B. A new technique for browse yield estimation.

A browse yield estimation technique is suggested that provides a fast accurate methodology for determining available annual browse weight per unit area. The technique relies on examination of approximately 30 one- by four-metre plots and 30 individual plants of each browse species present. A multiple regression of both plot and plant parameters on weight of new growth resulted in r values from .84 to .99 and r^2 values from .71 to .97. Plot parameters included total plot basal stem density, specific species density and plot height range. Plant parameters included basal diameter, plant height and number of new twigs. Of the species examined, r^2 values were higher for willow (Salix spp.) and aspen (Populus tremuloides) and lower for white birch (Betula papyrifera) and red-osier dogwood (Cornus stolonifera). Plot parameters contributed little to willow and aspen weight regressions but became important for white birch and red-osier dogwood, probably because of the latter two species' susceptibility to competition. The regression incorporates site variability into the equation and, therefore, could eliminate the need for numerous site-specific equations. The technique appears particularly suited to ongoing studies where fast weight estimates must be obtained from undisturbed browse plants. Limitations of the technique could exist under adverse or abnormal conditions such as drought or extremely heavy browsing pressure. The combination of this technique with twig diameter weight regressions should allow very accurate weight estimations despite adverse conditions and extreme site variability.

Subject headings: browse.

13. 81-15. CRICHTON, VINCE F.J. AND ROBERT B. WIELGUS. Browse utilization, health and habitat relations of moose on Hecla Island, Manitoba.

The moose population on Hecla Island, Manitoba was reduced from about 260 to 120-140 animals through hunting in an effort to maintain adequate browse supplies and reduce the potential of a major die-off. Herd productivity, however, did not appear to increase in proportion to herd size reduction. A study was initiated in 1979 to assess browse utilization, winter habitat selectivity and the relationships between habitat and the moose populations.

Subject headings: browse; moose - Manitoba.

14. 81-16. GABOURY, M.N. AND G.K. SPENCE. A report on the 1980 survey of brook trout (Salvelinus fontinalis) populations in remote Lower Nelson River tributaries.

Surveys conducted in 1980 indicated small numbers of brook trout in Nelson River tributaries downstream of the Limestone River. Capture methods included rotenone, gill nets and angling. Further studies on these tributaries are warranted before conclusive statements can be made on trout distribution and natural abundances.
On Sky Pilot Creek and the Limestone River, angler exploitation of trout was low and similar to 1979. In comparison to 1976, catch per angler-hour in 1980 was higher for Sky Pilot Creek but lower for 9-Mile Creek. Angling and netting on the Weir River was more intensive than previous years with fishermen concentrating on the main stem spawning area.

Subject headings: Trout, Brook - Manitoba; Nelson River, Manitoba.

15. 81-17. MILLIKEN, IAN. 1981 White-tailed deer carcass study in the Southwestern region.

Brandon technical staff and field staff in the Southwestern Region continued an annual project to pick up and examine white-tailed deer (Odocoileus virginianus) killed by collisions with vehicles and trains. Thirty-five deer were collected from January to March, 1981 inclusive. Twenty-one of the 35 deer came from the Brandon District. Thirteen fawn females had a fetal rate of 0.3 whereas four yearlings ($1\frac{1}{2}$ years) and 14 adults ($2\frac{1}{2}$ years and older) had fetal rates of 1.5 and 1.86 respectively. The twinning rate in adult females was 79 percent. All 35 deer examined were in excellent condition. Postnatal fawn mortality is expected to be negligible.

Subject headings: Deer, White-tailed - Manitoba.

16. 81-18. MILLIKEN, IAN J. Winter weather and white-tailed deer in the Southwestern Region - 1980 and 1981.

Weekly snow depths, snow compaction readings, chillometre readings and daily minimum temperatures were recorded by cooperators and field staff at three station in 1979-80 (1980) and in 1980-81 (1981) in the Southwestern Region. Weekly snow depths and daily minimum temperatures were also recorded at another seven and eight stations in 1980 and 1981. Both winters were considered very favourable for white-tailed deer (Odocoileus virginianus). Minimal snow depths, milder than normal winter temperatures and early spring "breakups" occurred both years. Winter deer mortality throughout the southwest was negligible. Maximum reproductive capability was realized in 1980 and can be expected again in 1981 due to the extremely favourable winter environmental conditions.

Subject headings: Deer, white-tailed - Manitoba; Snow measurement - Manitoba.

17. 81-19. MILLIKEN, I. An evaluation of the Lauder Sandhills Wildlife Management Area Habitat Development plots.

Regeneration on eleven rectangular sites (.2 to .8 hectares) handcut during the winter of 1977-78 in the Lauder Sand Hills Wildlife Management Area was excellent. Suckering and sprouting by aspen poplar (Populus tremuloides) and balsam poplar (P. balsamifera) following the first summer after cutting resulted in 182,201 stems per hectare. In addition, 308,701 shrub stems per hectare were also recorded. Sample plots with moderate to no slash had substantially more stems than plots with heavy slash. White-tailed deer (Odocoileus virginianus) browsed 21 percent of all available tree and shrub stems during the first summer. Red-osier dogwood (Cornus stolonifera), rose (Rosa sp.) and aspen were browsed most frequently at 42, 39 and 17 percent, respectively. Winter browsing by deer was very light.

Subject headings: Lauder Sandhills Wildlife Management Area Wildlife habitat improvement - Manitoba, Browse.

18. 81-20. LYSACK, W. 1980 Lake Winnipeg fish stock assessment program.

This report presents the results of the 1980 Lake Winnipeg fish stock assessment program. Maturity rates of northern and southern walleye and sauger females were not significantly different but southern female walleyes and saugers began maturation significantly earlier than their northern counterparts. Mean ages of maturity of walleyes and saugers were at least 2 years younger in the south basin than in the north basin. The maturity rate and mean age of maturity of the northern whitefish stock has not changed significantly since 1979.
Asymptotic sizes of walleyes and saugers generally decreased from the north end to the south end of Lake Winnipeg. Walleyes and saugers grew faster in the south basin than in the north basin. Whitefish growth rates have not changed significantly since 1979.
Mortality rates and catch curves of northern whitefish have remained essentially static since 1979. Mortality rates of northern walleye and sauger stocks have increased since 1979. The appearance of weak cohorts in southern walleye age compositions in 1980 is attributed to increased ageing precision. Southern Lake Winnipeg fishermen are relying on fewer cohorts composed of younger, immature fish. Use of smaller meshes and greater fishing effort on southern Lake Winnipeg is forcing saugers and walleyes to grow and mature at extremely high rates. The resiliency of the southern walleye stock is deteriorating. Northern walleye stocks are beginning to show compensatory increases in growth and maturity in response to heavier fishing pressure.

Subject headings: Lake Winnipeg, Manitoba; Walleye - Manitoba - Lake Winnipeg; Sauger - Manitoba-Lake Winnipeg.

19. 81-21. SEGARAN, S., G. FALK, AND D.M. GILLIS. Tree improvement and forest genetics program in Manitoba. 2. Laboratory germination tests of conifer seedlots.

Laboratory germination tests of conifer seedlots were conducted over the period January - March 1981, in a G-30 germinator having a standard, controlled, optimum environment. Estimates of germinative capacity with 95 percent confidence limits and germinative energy were obtained for each seedlot. In addition for every germinant the stage of seedling development was categorized into nine vigour classes.
Seed size and seed weight on a per gram basis have also been estimated. Seed quality and expectations of viability have also been computed.

Subject headings: Forest genetics; Tree breeding - Manitoba; Conifer seeds.

20. 81-22. GABOURY, M.N. & J.W. PATALAS. An interim report on the fisheries impact study of Cross and Pipestone Lakes.

East Cross Lake was shallower and had a greater plankton standing crop but a lower conductivity than either west Cross or Pipestone Lake. Catches per unit effort (C.U.E.) of whitefish, walleye and pike were on average highest in east Cross Lake and lowest in Pipestone Lake. Whitefish and pike populations in east Cross exhibited a characteristic reponse to exploitation with whitefish having a faster growth rate, younger age at maturity and fewer older fish in comparison to whitefish from west Cross. East Cross pike had a significantly higher mortality rate, a lower mean age of the catch and a younger age at maturity than pike in west Cross and Pipestone lakes. Walleyes from Cross and Pipestone lakes had similar age distributions, growth and maturity rates. Summer drawdown in 1980 reduced the volumes of Cross and Pipestone lakes to 47% of their average historic volumes. Also mean water depths were lowered by 20 to 50% to 1.9 m in west Cross and 0.7 m in east Cross respectively.
In comparison to previous fisheries studies on Cross Lake, large whitefish and pike had declined in relative abundance while walleye remained unchanged. Also, C.U.E. of large whitefish had declined since 1977. It is believed that since Jenpeg regulation, decreases in lake volume and area have reduced the available habitat for fish, plankton and benthos, and resulted in a lower standing crop of particularly whitefish, as well as pike and walleye. Early spring drawdown of Cross Lake may be affecting whitefish and cisco hatching success and recruitment, through a de-watering of their spawning areas and dessication of the eggs.
Domestic fishermen from Cross Lake harvested approximately 60,000 kg. of whitefish, pike, walleye, cisco and sucker between August 4, 1980 and February 1, 1981.

Subject headings: Fisheries - Manitoba - Cross Lake; Fisheries - Manitoba - Pipestone Lake; Cross Lake - Manitoba; Pipestone Lake - Manitoba.

21. 81-23. O'CONNOR, J.F. Growth, size and lipid content declines of lake whitefish (Coregonus clupeaformis) in Lake Winnipeg following recovery of the fishery.

Lipid content and growth characteristics of Lake Winnipeg whitefish populations were reviewed to determine the cause of decline in quality of fish in the commercial catch in recent years. Significant correlations existed for lipid content against weight and condition factors for whitefish sampled from Berens River and Grand Rapids areas. There has been a significant

decrease in growth rates since the fishery reopened in 1971 after the mercury closure and an abrupt decline in length, weight and condition factors in the commercial catch since 1975. Correlated with the decline in size was an expansion of the whitefish population into Grand Rapids, Berens River, North Channel and Channel areas and 214% increase in yields from 1975 to 1979. This increase in yield was related to strong year classes that developed during the 1968-1970 period when adult stocks were depressed and the 1974-1975 period when low quotas permitted a high escapement of spawners. The deterioration in quality of whitefish was related to intensified intra-specific competition from expanding populations causing density-dependent responses of growth and condition factor declines. No evidence was found that the growth decline in Lake Winnipeg whitefish was related to introduction of Clearwater Lake stock. The potential scope for growth-compensatory responses indicates that whitefish stocks could withstand an increase in fishing mortality if quotas were raised. It is concluded that increased exploitation should produce an increased growth rate, a larger size fish in the fishery and a better quality product for the smoker trade.

Subject headings: Whitefishes, Lake Winnipeg; Lake Winnipeg, Manitoba.

22. 81-24. HAGENSON, I. AND F.F. O'CONNOR. A fisheries inventory of Harrop, Eardley, Weaver and Wrong Lakes.

This study was conducted from July 27, 1978 to August 24, 1978 to determine the sport fish potential of Harrop, Eardley, Weaver and Wrong lakes and to provide baseline data to permit recommendations for improving recreational fishing opportunities. All of the study lakes are eutrophic headwater lakes with potential for high quality recreational fisheries. The lodges and outcamps on Harrop, Eardley and Wrong lakes have had no major adverse effect on the sport fish populations of these lakes. Weaver Lake is a relatively large shallow lake which has potential for good sport fishing for walleye if developed as an outcamp or day use lake.

Subject headings: Fishing, Sport - Manitoba, North; Harrop Lake, Manitoba; Eardley Lake - Manitoba; Weaver Lake - Manitoba; Wrong Lake - Manitoba.

23. 81-25. BRUERDERLIN, B. AND B.H. WRIGHT. A creel census of Reed Lake, 1979.

A creel census and fish sampling program was conducted on Reed Lake for 26 randomly selected days in the months of May, June, July, August and September of 1979. The angler harvest is composed of northern pike (Esox lucius), walleye (Stizostedion vitreum vitreum), and lake trout (Salvelinus namaycush). Anglers were interviewed upon returning to the landing as to the number and species of fish caught and released, hours spent angling, and anglers' place of residence. It is assumed that the number of fish caught included those consumed as shore lunches. In addition, 270 northern pike, 242 walleye and 80 lake trout were measured (fork length), weighed and fin and scale samples removed. During the summer of 1979, anglers were estimated to have caught 38,000 principal game fish. They retained an estimated 15,000 game fish. The total estimated angler harvest of game fish in 1979 for Reed Lake was 24,700 kg (54,400 lbs.) or 12.0 kg/ha (1.0716 lbs/ac). Of this 24,700 kg of game fish, northern pike represented 14,107 kg, walleye 8,300 kg and lake trout 2,286 kg. The MSY for Reed Lake is 3.87 kg/ha (3.45 lb/ac) or 79,614 kg. (175,381 lb) per year for all species (Blunt, 1975). From Schlick's gill netting survey 1962-63 game fish comprised 37.2% of the total fish caught. This 37.2% represents an MSY (maximum sustained yield) of 29,616 kg of game fish which is just slightly higher than the total estimated angler harvest of game fish for Reed Lake.
The catch per angler hour (C.U.E.) during the summer of 1979 based on actual interview results was 2.44 for all species and 2.36 for principal game fish (northern pike, walleye, lake trout).
Approximately 75% of anglers fishing on Reed Lake during the summer of 1979 were non-resident American; 23% were Manitobans, 2% were non-Manitobans (Canadians) and .4% were other.

Subject headings: Fishing, Sport - Manitoba; Reed Lake, Manitoba.

24. 81-26. JOHNSON, BRAD C. A survey of nesting Canada Geese (Branta canadensis maxima) at Reykjavik, Manitoba, 1981.

Field survey for monitoring the local nesting population of giant Canada Geese (Branta canadenis maxima) at Reykjavik, Manitoba, were conducted from May 5 through May 27, 1981. Eighty-five nests were located within the Bluff Harbour, Johnson Lake, East Shore Islands and Lussier study areas (Fig. 1). This total represents a 6.6% decrease in the nesting populations compared to the mean of the four previous years. One hundred and thirteen additional nests were located in new areas searched. Nests were distributed between mainland sites (61%) and island sites (39%). Nesting densities between mainland and island sites were 0.05 nests/ha (0.02 nests/acre and 0.32 nests/ha (0.13 nests/acre) respectively. Clutch

size varied between 1 - 8 eggs with a mean of 4.7 eggs. Seventy-seven percent of the nests hatched successfully. A total of 45 neck-collared birds were observed with individual alpha-numeric codes being recorded on 41 of these birds. Four of these were observed incubating clutches.

Subject headings: Geese, Canada - Manitoba.

81-27. Not completed.

25. 81-28. VANDERPONT, CATHY A. 1980/1 Big game hunter survey.

Results of a mail survey of Resident Deer, Resident Special and General Moose, Resident Elk/Moose and Non-Resident Moose licencees following the close of the 1980/81 season. Reported data was compiled from the questionnaires returned and estimates were performed on the reported data.

Subject headings: Big game - Manitoba - surveys; Hunting - Manitoba - surveys.

26. 81-29. BRADLEY, R. & TARDI, C. Municipal Shooting bylaws.

Results of a survey of municipalities and local government districts.

Subject headings: Shooting - Manitoba - bylaws; Hunting - Manitoba - bylaws.

27. 81-30. BIDLAKE, LARRY. 1980 Spruce Woods-Shilo elk season in Game Management Area 30.

Three separate elk hunting seasons were held in Game Hunting Area (G.H.A.) 30 during the fall of 1980. An early archery season with no limit on available licences preceded a fall trophy bull season and a winter season. The fall rifle and winter seasons had limited numbers of licences, available only through a draw. The 1980 season saw the introduction of a "two licence/one tag" system for all draw hunters. Landowners within G.H.A. 30 were given the opportunity to buy licences for use on land they owned. Questionnaires were sent to all hunters at the conclusion of each separate season. Of 346 questionnaires sent, 290 were completed for a response rate of 84%. A total of 64 jaws were collected from a known total of 71 elk that were killed. A total of 27 elk were weighed with complete or partial morphometric measurements recorded, in addition to 30 sets of antlers being measured.

Overall hunting success was close to what was predicted. Hunter-landowner conflict was low and no major enforcement problems were encountered. Landowners welcomed the opportunity to get a licence without competing with other hunters in the draw. The season was gauged to have been successful without overharvest of any particular segment of the herd.

Subject headings: Elk hunting - Manitoba.

II. TECHNICAL REPORTS

28. 81-1. DIXON, R.J. Vegetation mapping the barrenground caribou winter range in Northern Manitoba using LANDSAT.

Six vegetation cover maps, at a 1:250,000 scale, were produced for an area of approximately 76,500 square kilometres in northern Manitoba, using LANDSAT multispectral scanner data. The mapping was performed to determine the quantity and quality of barrenground caribou winter range.
Principal component colour enhancements of LANDSAT data were found to be the most appropriate analysis method. This digital image enhancement technique supported with aerial photography, black-and-white LANDSAT images and ground sampling enabled identification of twelve vegetation and three burn cover type units.
Two other LANDSAT analysis techniques were also evaluated as possible ways of providing the mapping required. The techniques involved visual interpretation of LANDSAT film positives and a LANDSAT digital classification. Cover types identified by visual interpetation of LANDSAT film positives were not adequate for use by the caribou manager. Results of LANDSAT digital classification were inconclusive due to technical problems experienced with imagery and data analysis.

Subject headings: Vegetation mapping - Manitoba; Remote Sensing - Manitoba; Caribou, Barrenground - habitat - Manitoba.

III. UNUMBERED PUBLICATIONS - FISHERIES AND WILDLIFE

29. (FISHERIES BRANCH). Recommended fish protection procedures for stream crossings in Manitoba.

Recommendations prepared by the Fisheries Branch as an aid to engineers and developers in constructing stream crossings with minimal damage to fish and fish habitat.

Subject headings: Fishways; Culverts.

30. GOULDEN, HERB. The white-tailed deer in Manitoba. 32 p. illus.

This booklet presents a general profile of the Manitoba white-tailed deer and answers some of the questions commonly asked.

Subject headings: Deer, white-tailed.

IV. PARKS BRANCH

31. ESAU, FRIEDA KATHLEEN. Cultural history: Hecla Provincial Park.

Describes and rates the themes that may be used by the Parks Branch in cultural history programs in the Park. Limited distribution.

Subject headings: Hecla Provincial Park.

32. Grass River Provincial Park Master Plan: Progress report and final objectives.

Provides a summary of the public response to the planning objectives set down in the newsletter entitled "Towards a Master Plan for Grass River Provincial Park."

Subject headings: Grass River Provincial Park - Parks - Manitoba - Planning.

33. Grass River: towards a Master Plan for Grass River Provincial Park.

This booklet explains the Park Master Plan process and summarizes important information about Grass River Provincial Park. Includes a questionnaire to provide for comment by the interested public.

Subject headings: Grass River Provincial Park; Parks - Manitoba - Planning.

34. Manitoba Park Statistics 1980.

Subject headings: Parks - Manitoba - Statistics.

35. PATTIMORE, JOHN. Snow activity program.

Includes information and activities which relate Park winter landscapes to school curricula.

Subject headings: Outdoor recreation - Winter.

36. PARKS BRANCH. Turtle Mountain Provincial Park Master Plan. Part 1: Objectives for Turtle Mountains.

This booklet explains the Park Master Plan process & summarizes important information about Turtle Mountain Provincial Park.

Subject headings: Turtle Mountain Provincial Park - Parks - Manitoba - Planning.

37. PARKS BRANCH. Turtle Mountain Provincial Park Master Plan: Progress report and final objectives.

Provides a summary of the public response to the planning objectives set down in Turtle Mountain Provincial Park Master Plan. Part 1. Objectives for Turtle Mountain.

Subject headings: Turtle Mountain Provincial Park - Parks - Manitoba - planning.

38. MANITOBA. PARKS BRANCH. The Whiteshell Master Plan. Draft Plan. (Summary).

This summary of the Draft Master Plan highlights the major proposals in the draft. The principal sections of the plan -- zoning, recreational facilities, visitor services, resource management, fees and implementation - are briefly presented together with selected maps and tables from the draft plan.

Subject headings: Whiteshell Provincial Park - Parks - Manitoba - Planning.

39. The Whiteshell Master Plan: Progress report and final objectives.

Provides a summary of the public response to the planning objectives set out in The Whiteshell Master Plan Part 1: An overview of the Parks System with preliminary objectives for Whiteshell.

Subject headings: Whiteshell Provincial Park - Park - Manitoba - Planning.

V. WATER RESOURCES BRANCH

40. 81/1 KOZUSKO, D.J. Surface water management plan for the Upper Whitemud River Watershed (Watershed No. 40).

Subject headings: Whitemud River Watershed; Water resources development - Manitoba.

41. 81/2 CANADA-MANITOBA AD HOC TASK FORCE ON MANITOBA FLOOD MITIGATION PROJECTS. Report on Manitoba flood mitigation projects: Red River Valley ring-dyke communities; Carman, Ste. Rose du Lac, Gimli.

Subject headings: Flood damage reduction - Manitoba.

42. 81/2A SCHELLENBERG, H.D. HARRISON, R.W. AND W.A. OSIPA. (Manitoba members of the Ad Hoc Task Force on Manitoba Flood Mitigation Projects). Report on additional special considerations of flood control at Carman and Ste. Rose du Lac.

Subject headings: Flood control - Manitoba.

43. 81/3 RUTULIS, M. Groundwater resources in the Eastern Interlake planning district.

Subject headings: Water-supply - Manitoba - Eastern Interlake.

44. 81/4 RUTULIS, M. Groundwater resources in the Willowbend Creek Watershed.

Subject headings: Water-supply - Manitoba - Willowbend Creek Watershed; Willowbend Creek Watershed, Manitoba.

45. 81/5 WATER MANAGEMENT SERVICE. Suspended sediment data acquired by the Manitoba Water Resources Branch.

Subject headings: Sediment, suspended - Manitoba.

46. 81/6 HARRISON, R.W. Flood protection for the town of Deloraine.

Subject headings: Flood control - Manitoba - Deloraine.

47. 81/7 RUTULIS, M. Groundwater conditions in the Pasquia Lake Area.

Subject headings: Water-supply - Manitoba - Pasquia.

48. 81/8 WARKENTIN, A.A. AND D.N. WALKER. Climatological study Turtle Mountain Conservation District No. 4.

Subject headings: Manitoba - Climate; Turtle Mountain Conservation District - Climate.

49. 81/9 HARRISON, R.W. AND SCHELLENBERG, H. Irrigation feasibility in Willowbend Creek Watershed (Watershed No. 35).

Subject headings: Willowbend Creek Watershed, Manitoba; Irrigation - Manitoba - Willowcreek Watershed.

50. 81/10 MOHR, G. Rice Lake Dam feasibility study.

Subject headings: Dams - Cold Creek; Rice Lake Dam - Manitoba.

51. 81/11 MOHR, G. Proposed Rock Lake Dam (fsl 1331) one mile west of PR 342.

Subject headings: Dams - Rock Lake; Rock Lake Dam - Manitoba.

52. 81/12 RUTULIS, M. Groundwater resources in the town of Steinbach: a synopsis.

Subject headings: Water-supply - Manitoba - Steinbach.

53. 81/13 RUTULIS, M. Groundwater resources in the Brandon and area planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Brandon.

54. 81/14 RUTULIS, M. Groundwater resources in the Ste. Rose planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Ste. Rose.

55. 81/15 RUTULIS, M. Groundwater resources in the Mossey River planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Mossey River.

56. 81/16 RUTULIS, M. Groundwater resources in the Swan River planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Swan River.

57. 81/17 RUTULIS, M. Groundwater resources in the Nor-Mac planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Nor-Mac Planning District.

58. 81/18 RUTULIS, M. Groundwater resources in the R.M. of La Broquerie planning district (a synopsis).

Subject headings: Water-supply - Manitoba - La Broquerie.

59. 81/19 RUTULIS, M. Groundwater resources in the Cooks Creek conservation district.

Subject headings: Water-supply - Manitoba - Cooks Creek Conservation District; Cooks Creek Conservation District.

60. 81/20 RUTULIS, M. Groundwater resources in the Turtle Mountain - Killarney planning district: a synopsis.

Subject headings: Water-supply - Manitoba - Turtle Mountain - Killarney; Turtle Mountain - Killarney planning district - Manitoba.

61. 81/21 TOYE, J. Canada-Manitoba flood damage reduction program, City of Winnipeg and additional zone: interim flood risk mapping study.

Subject headings: Flood damage reduction - Manitoba - Winnipeg.

VI. BOOKS, PERIODICAL ARTICLES

62. NERO, BOB. Birds. 1. Canadian Album Series. A colouring adventure in Canadian themes. Winnipeg, Hyperion Press.

Subject headings: Birds.

63. NERO, BOB. Birds. 2. Canadian Album Series. A colouring adventure in Canadian themes. Winnipeg. Hyperion Press.

Subject headings: Birds.

64. DOYLE, DEREK. Whiteshell Master Plan. Wildlife Crusader, 27 (no. 1) Winter 1981, 5, 14-17.

Subject headings: Whiteshell Provincial Park.

65. GOULDEN, HERB. Manitoba deer hunt 1980: Provincial Deer Manager's Report. Wildlife Crusader 27(2) April 1981, 12-13.

Subject headings: Deer hunting - Manitoba.

66. GOULDEN, HERB. Winter deer feeding in Manitoba. Wildlife Crusader 27 no. 6 (1981) 4-7.

Subject headings: Deer, white-tailed.

67. KOONZ, BILL. Marooned! Manitoba Nature 22(3) 18-23, 42-43.

A search for rare falcons on the Churchill River leads to tragedy, a struggle for life and insights into survival.

Subject headings: Survival.

68. MALECKI, RICHARD E., F. DALE CASWELL, RICHARD W. BISHOP, KENNETH M. BABCOCK, AND MURRAY GILLESPIE. A breeding-ground survey of EPP Canada geese in northern Manitoba.

Aerial surveys flown in northern Manitoba during 1972-77 were used to determine indices of spring breeding populations and distributions of Eastern Prairie Population (EPP) Canada geese (Branta canadensis). Precision within ±20% of the survey results ($P = 0.05$) was achieved by using stratified random sampling and optimum allocation procedures. Variability among observers was negligible. However, comparisons between counts made from fixed-wing aircraft and helicopters indicated that breeding-pair estimates should be multiplied by about 1.4 to adjust for birds not seen. Distribution of nesting geese strongly favoured the coastal areas bordering Hudson Bay. A section of tundra habitat comprising less than 8% of the 154,600/km^2 survey area contained 44-67% of the total breeding pairs during the 1st 4 years. Average annual nest densities in lowland habitat near the Hudson Bay coast ranged from 0.17-0.32 pairs/km^2, whereas more-interior areas seldom exceeded 0.12 pairs/km^2.

Subject headings: Geese, Canada.

69. NERO, ROBERT W. Additional American Woodcock notes for Manitoba. Blue Jay 39 (4) 202-205 (1981).

Subject headings: Woodcock, America.

70. NERO, ROBERT W. AND COPLAND, HERBERT W.R. High mortality of great gray owls in Manitoba - Winter 1980-81. Blue Jay 39 (3) 158-165. 1981.

Subject headings: Owls, Great Gray.

71. NERO, BOB. Jail birds make good. Wildlife Crusader 27 (5) 1981 18-19.

The successful release of four peregrine falcons in Winnipeg, the Manitoba Department of Natural Resources' contribution to international efforts to restore the species.

Subject headings: Peregrine falcons.

72. NERO, ROBERT W. Peaceable Bald Eagle, fast flying forest hawks. Defenders of Wildlife Magazine 56 April 1981, 23-32.

Subject headings: Eagles, Bald.

SURVEYS AND MAPPING see also No. 28

73. POKRANT, HARTLEY. Remote sensing to assess distribution of leafy spurge in the Spruce Woods Provincial Park.

The Parks Branch, of the Provincial Department of Natural Resources, is concerned about the reduction and control of leafy spurge (Euphorbia esula L.) within the Spruce Woods Provincial Park, south of the Assiniboine River. The park is considered a source area from which leafy spurge may spread to surrounding agricultural and pasture areas.
To assess the problem and establish the criteria for control, the Parks Branch decided its first objective was to determine the extent and distribution of leafy spurge within the study area. It was decided that remote sensing was the best way of obtaining this information.
This report deals with the use of remotely sensed data to record and map the distribution of leafy spurge plant communities within the Spruce Woods Provincial Park.
Color transparencies at a scale of 1:43,240 were chosen as the primary data source for interpretation purposes. The

interpreted leafy spurge cover was then classified by density within a given area using a numeric value. This information was then transferred to a black and white photo base map which had been created from aerial photography flown in 1977 at a scale of 1:15,840. A "leafy spurge distribution map" was then produced for the Spruce Woods Provincial Park.

Subject headings: Remote sensing; Spurge, leafy; Spruce Woods Provincial Park.

74. 81-03. POKRANT, HARTLEY. Remote sensing to assess the distribution of leafy spurge for selected areas of C.F.B. Shilo from 1978-1981.

The Shilo Environmental Advisory Committee (S.E.A.C.) was initially established to assess the impact of military activity on the ecology of high usage areas within the Canadian Forces Base Shilo. One of the committee's first objectives was to determine what vegetation existed and what condition it was in. To meet this objective, a remote sensing mapping project was conducted in 1979 which provided vegetation cover maps of the high use areas.
Analysis of these maps indicated the presence of high quantities of leafy spurge (Euphorbia esula) on the military reserve. The reserve has been considered a source from which leafy spurge is spreading to surrounding range and pasture lands. Concern was then expressed by the Committee about the control and reduction of leafy spurge. As a result of this concern, it was decided that a follow-up mapping project be conducted which would show the present extent and distribution of leafy spurge communities.
This report deals with the use of remotely sensed data to record and map the distribution of leafy spurge communities in the five high use areas and the main fireguard around the perimeter of the reserve.
Color infrared photography flown at three different years was chosen as the primary data source for interpretation purposes. The leafy spurge boundaries were then transferred to clear mylars from which color overlays were made for each year. The color overlays were superimposed with black and white photo mosaics. Observations and calculations could now be made as to the extent of and/or recession of leafy spurge growth over the period of 1978 to 1981 and also to statistically assess the distribution.
The fireguard was photographed only in 1981, hence, the maps for this area show leafy spurge communites for only that year.

Subject headings: Remote sensing; Spurge, Leafy; Shilo C.F.B.

INDEXES

(The numbers used in the indexes refer to the numbers in the bibliography, not page numbers)

AUTHOR INDEX

Bidlake, Larry 27
Bradley, R. 26
Bredin, E.J. 6, 7
Bruerderlin, B. 23

Canada-Manitoba Ad Hoc Task Force on Manitoba Flood
Mitigation Projects 41
Caswell, F. Dale 68
Copland, Herbert W.R. 70
Crichton, Vince F.J. 10, 13

Dixon, R.J. 28
Doyle, Derek 64

Erickson, C.M. 4
Esau, Frieda Kathleen 31

Falk, G. 19

Gaboury, M.N. 14, 20
Garrod, R.C. 5
Gillis, D.M. 19
Goulden, Herb 30, 65, 66

Hagenson, I. 22
Harrison, R.W. . . . . 42, 46, 4[illegible]

Jardine, C.G. 2
Johnson, Brad C. 24

Koonz, Bill 67
Kozusko, D.J. 40

Lysack, W. 4, 18

Malecki, Richard E. 68
Milliken, Ian J. 8, 9, 15, 16, 17
Mohr, G. 50, 51

Nero, Robert W. 62, 63, 69, 70, 71, 72

O'Connor, J.F. 21, 22
Osipa, W.A. 42

Patalas, J.W. 20
Pattimore, John 35
Pokrant, H. 73, 74

Rutulis, M. 43, 44, 47, 52, 53, 54
55, 56, 57, 58, 59, 60

Schellenberg, H.D. 42, 49
Segaran, S.G. 3, 19
Shoesmith, M.W. 5
Sigurdson, J.S. 2
Spence, G.K. 14
Stewart, J.M. 5

Tardi, C. 26
Toye, J. 61

Vanderpont, Cathy A. 25

Walker, D.N. 48
Warkentin, A.A. 48
Water Management Service 45
Wielgus, Robert B. 11, 12, 13
Wright, B.H. 23

BRANCH INDEX

Fisheries 2, 4, 14, 18, 20, 21, 22, 23, 29

Forestry 3, 19

Library Services 1

Parks 31, 32, 33, 34, 35, 36, 37, 38, 39, 64

Public Information Services 26

Surveys and Mapping 28, 73, 74

Water Resources 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61

Wildlife 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 24, 25, 27, 30, 62, 63, 65, 66, 67, 68, 69, 70, 71, 72

SUBJECT INDEX

Aerial survey techniques - wildlife 8

Bald eagles 72
Big game - surveys 25
Birds 62, 63
Brook trout 14
Browse 9, 11, 12, 13, 17

Canada geese 24, 68
Caribou, Barrenground 28
Climate 48
Conifer seeds 19
Cooks Creek Conservation District 59
Cross Lake 20
Culverts 29

Dams - Cold Creek 50
Dams - Rock Lake 51
Deer, White-tailed 5, 8, 15, 16, 30, 65, 66

Eagles, Bald 72
Eardley Lake 22
Elk 5, 27

Falcons 71
Fire ecology 11
Fisheries 4, 14, 18, 20, 21
Fisheries - bibliography 1
Fishing - Sport 2, 14, 20, 23
Fishing Lake 2
Fishways 29
Flood control 42, 46
Flood damage reduction 41, 61
Forest genetics 3, 19
Forestry bibliography 1

Geese, Canada 24, 68
Grass River Provincial Park 32, 33
Great Gray Owls 70
Groundwater - Eastern Interlake 43
Groundwater - Willowbend Creek Watershed 44
Groundwater - Pasquia Lake 47
Groundwater - Steinbach 52
Groundwater - Brandon 53
Groundwater - Ste. Rose 54
Groundwater - Mossey River 55
Groundwater - Swan River 56
Groundwater - Cooks Creek Conservation District 59

Groundwater - Nor-Mac Planning District 57
Groundwater - La Broquerie 58
Groundwater - Turtle Mountain - Killarney 60

Harrop Lake 22
Hecla Provicial Park 31
Hunting - Bylaws 26
Hunting - Surveys 25

Irrigation - Willow Creek Watershed 49

Lake Regulation - effects on fisheries 20
Lake Winnipeg 4, 18, 21
Lauder Sandhills Wildlife Management Area 9, 17
Lizards 7

Moose 5, 10, 11, 13
Mossey River Planning Distirct 55

Natural resources bibliography 1
Nelson River 14
Nor-Mac Planning District 57

Outdoor education 35
Owls, Grat Gray 70

Parks - Planning 32, 33, 36, 37, 38, 39, 64
Parks - Statistics 34
Peregrine falcons 71
Pipestone Lake 20

Reed Lake 23
Remote sensing 28, 73, 74
Rice Lake Dam 50
Rock Lake Dam 51

Sasaginnigak Lake 2
Sauger 4, 18
Sediment data 45
Shilo C.F.B. 74
Shooting - bylaws 26
Skink 7
Snakes 6
Snow activities 35
Snow measurement 16
Spruce Woods Provincial Park 73
Spurge, Leafy 73, 74
Survival 67

Tree breeding 3, 19
Trout, Brook 14
Turtle Mountain Conservation District 48
Turtle Mountain Provincial Park 36, 37
Turtle Mountain - Killarney Planning District 60

Vegetation mapping 28

Walleye 18, 22
Water-supply see Groundwater
Watershed management 40
Weaver Lake 22
Western hognose snake 6
White-tailed deer see Deer, White-tailed
Whitefishes 18, 21
Whitemud River Watershed 40
Whiteshell Provincial Park 38, 39, 64
Wildlife - bibliography 1
Wildlife habitat improvement 9, 11, 17
Willowbend Creek Waterhsed 44, 49
Winter activities 35
Woodcock, American 69
Wrong Lake 22

TITLE INDEX

Additional American Woodcock notes for Manitoba 69
Annotated bibliography renewable resource publications of the Department of Natural Resources 1980 1
Application of quadrat plot sampling to an aerial census of white-tailed deer in Southwestern Manitoba 8

Birds 1. Canadian Album Series. A colouring adventure Canadian themes 62
Birds 2. Canadian Album Series. A colouring adventure Canadian themes 63
A breeding-ground survey of EPP Canada geese in northern Manitoba 68
Browse utilization, health and habitat relations of moose on Hecla Island, Manitoba 13

Canada-Manitoba flood damage reduction program, City of Winnipeg and additional zone: interim flood risk mapping study 61
Climatological study Turtle Mountain Conservation District No. 4 48
A creel census of Reed Lake, 1979 23
Cultural history: Hecla Provincial Park 31

Distribution of the Northern Prairie Skink in Manitoba 7
Distribution of the Western hognose snake in Manitoba 6

Effects on fire on the shrub layers of young and mature aspen forest and implications for moose habitat management 11
An evaluation of the Lauder Sandhills Wildlife Management Area Habitat Development plots 17

A fisheries inventory of Harrop, Eardley, Weaver and Wrong Lakes 22
Flood protection for the town of Deloraine 46

Grass River Provincial Park Master Plan: Progress report and final objectives 32

Grass River: towards a Master Plan for Grass River Provincial Park 33
Groundwater resources in the Brandon and area planning district: a synopsis 53
Groundwater resources in the Cooks Creek conservation district 59
Groundwater resources in the Eastern Interlake planning district 43
Groundwater resources in the Mossey River planning district: a synopsis 55
Groundwater resources in the Nor-Mac planning district: a synopsis 57
Groundwater conditions in the Pasquia Lake Area 47
Groundwater resources in the R.M. of La Broquerie planning district (a synopsis) 58
Groundwater resources in the Ste. Rose planning district: a synopsis 54
Groundwater resources in the Swan River planning district: a synopsis 56
Groundwater resources in the town of Steinbach: a synopsis 52
Groundwater resources in the Turtle Mountain - Killarney planning district: a synopsis 60
Groundwater resources in the Willowbend Creek Watershed 44
Growth, size and lipid content declines of lake Whitefish (Coregonus clupeaformis) in Lake Winnipeg following recovery of the fishery 21

High mortality of great gray owls in Manitoba - Winter 1980-81 70

An interim report on the fisheries impact study of Cross and Pipestone Lakes 20
Irrigation feasibility in Willowbend Creek Watershed (Watershed No. 35) 49

Jail birds make good 71

Lauder Sand Hills Wildlife Management Area habitat development project; stem counts 1978-1980. Southwestern Manitoba 9

Manitoba deer hunt 1980: Provincial Deer Manager's Report 65
Manitoba Park Statistics 1980 34
Marooned! 67
Moose in Manitoba - 1980 10

Municipal shooting bylaws 26

A new technique for browse yield estimation 12
1980/1 Big game hunter survey 25
1980 Lake Winnipeg fish stock assessment program 18
1980 Spruce Woods-Shilo elk season in Game Management Area 27
1981 White-tailed deer carcass study in the Southwestern region 15

Peaceable Bald Eagle, fast flying hawks 72
Proposed Rock Lake Dam (fsl 1331) one mile west of PR 342 51

Recommended fish protection procedures for stream crossings in Manitoba 29
Remote sensing to assess distribution of leafy spurge in the Spruce Woods Provincial Park 73
Remote sensing to assess the distribution of leafy spurge for selected areas of C.F.B. Shilo from 1978-1981 . . . 74
Report on additional special considerations of flood control at Carman and Ste. Rose du Lac 42
Report on Manitoba flood mitigation projects: Red River Valley ring-dyke communities; Carman, Ste. Rose du Lac, Gimli 41
A report on the 1980 survey of brook trout (Salvelinus fontinalis) populations in remote Lower Nelson River tributaries 14
Rice Lake Dam feasibility study 50
Rumen analyses of white-tailed deer, elk and moose killed by hunters and vehicle collisions in Manitoba 1975-1978 5

Seasonal and population growth parameters of southern Lake Winnipeg saugers 4
Snow activity program 35
A sport fisheries investigation of Sasaginnigak and Fishing Lkae, 1979 2
Surface water management plan for the Upper Whitemud River Watershed (Watershed No. 40) 40
A survey of nesting Canada Geese (Branta canadensis maxima) at Reykjavik, Manitoba, 1981 24
Suspended sediment data acquired by the Manitoba Water Resources Branch 45

Tree improvement and forest genetics programs in the Province of Manitoba. 1. Project details and specific objectives 3
Tree improvement and forest genetics program in Manitoba. 2. Laboratory germination tests of conifer seedlots 19
Turtle Mountain Provincial Park Master Plan. Part 1: Objectives for Turtle Mountain 36
Turtle Mountain Provincial Park Master Plan: Progress report and final objectives 37

Vegetation mapping the barrenground caribou winter range in Northern Manitoba using LANDSAT 28

The white-tailed deer in Manitoba 30
Whiteshell Master Plan 64
The Whiteshell Master Plan. Draft Plan (Summary) 38
The Whiteshell Master Plan. Progress report and and final objectives 39
Winter western and white-tailed deer in the Southwestern Region - 1980 and 1981 16
Winter deer feeding in Manitoba 66